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## PLASTER COMPOSITION HAVING INCREASED AIR ENTRAINMENT

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### ABSTRACT OF THE DISCLOSURE

A plaster composition is prepared having superior air entraining properties and reduced bulk density subsequent to setting, comprising a settable gypsum plaster and a minor amount of a water-soluble salt of the ester formed by reacting styrene-maleic anhydride copolymer with a monohydric alcohol of about 1 to 12 carbon atoms. Amounts of about 0.05 to 5 weight percent of the ester salt, based on the weight of the plaster, have been found to be effective in increasing air entrainment and thereby lowering bulk density in the plaster composition.

This invention relates to a plaster composition containing an air entrainer additive. More particularly this invention relates to a composition comprising settable gypsum plaster and a polymeric ester salt derived from styrene-maleic anhydride copolymer and an alcohol.

Settable gypsum plaster can be made by calcining gypsum ( $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ ) to remove most of the water of crystallization and form the hemihydrate. In the manufacture of structural materials containing calcined gypsum such as, for example, gypsum wall board, it is highly desirable to produce a final composition having a low bulk density without producing a composition having a prolonged time required for setting. The various reasons for this are, of course, that the lighter product is easier to handle in construction operations and in addition the lighter product, which contains substantial quantities of air entrained therein, has higher insulating value.

Water-soluble foaming agents have been employed as air entraining agents to lower the density of gypsum wallboards, for example alkali metal resin soaps and mono or dihydroxy lower alcohols have been employed as air entraining agents in gypsum. When these agents are employed as air entraining additives, foaming occurs by mechanical agitation of the aqueous solution of resin soap alcohol. The foam is then metered into the gypsum slurry. This procedure requires a foam of uniform bubble size and distribution, space-consuming foam tanks, in-line foam producers of dependable action, and a resin soap of composition. Resin soaps commonly employed, moreover, are derived from waste matter of natural origin. The composition of products obtained in this manner is usually difficult to control and subsequently their performance cannot be predicted accurately.

It is therefore an object of this invention to provide air entraining additives which lower the bulk density of settable gypsum plasters and which additives, unlike compositions based upon resin soaps of waste matter of natural origin, are derived from polymeric esters of synthetic copolymers, which are prepared by controlled and estab-

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lished methods. It is a further object of this invention to provide an air entraining additive for settable gypsum plasters which does not require foam tanks, in-line mixers or foam metering devices.

These and other objects are achieved in the present invention by providing a novel plaster composition having improved air entraining properties and comprising a settable gypsum plaster, and a minor portion, for example, from about 0.05 to 5 weight percent or more based on the weight of the plaster, preferably about 0.1 to 2 weight percent, of a water-soluble polymeric ester salt derived from styrene-maleic anhydride copolymer and an alcohol. The settable gypsum is usually the major amount of the composition on a dry basis.

The ester salts of this invention include the water-soluble alkali metal hydroxides, ammonia, hydrocarbon amine and basic aminoalcohol salts, which are prepared by neutralizing the half-ester. The various water-soluble, salt-forming basic hydrocarbon amines may be employed in the present invention to form basic amine salts of the half-ester. Preferred amines are tertiary amines such as, for example, trifurfuryl amines. Alcohol amines, such as for example triethanolamines, may be employed as well as glycol amines of molecular weight up to about 1500 or capped glycol amines of molecular weights up to about 5000.

The plaster composition of this invention can be prepared conveniently by adding the neutralized ester salt either in dry form or as a solution or paste to the calcined gypsum plaster prior to, with or after the addition of sufficient water to cause the plaster to set. Thus the ester salt can be removed from the water and the dried ester salt mixed with the dry gypsum plaster to form plaster compositions of this invention. This does not, however, exclude other procedures which may be employed advantageously. For example, the ester salt may be added to the plaster slurry after water has been added but before the plaster has had an opportunity to set sufficiently to preclude mixing or the ester salt may be added to the water itself which is to be mixed with the plaster.

The styrene-maleic anhydride copolymer employed in the present invention contains a molar ratio of polymerized styrene to polymerized maleic anhydride of about 1:1 to 4:1 and has an average molecular weight prior to esterification of about 500 to 500, preferably about 1500 to 3000. The copolymer is reacted with a suitable alcohol to form the about 20 to 100 or more percent, preferably about 40 to 75 percent, half-ester.

Preparation of the styrene-maleic anhydride copolymer can be by known methods. A preferred method is by solution polymerization where the monomers are polymerized in a suitable solvent employing as a polymerization catalyst a free-radical catalyst, such as a peroxide, preferably benzoyl peroxide, dicumyl peroxide or an alkyl peroxy dicarbonate, at a temperature of about 75 to 300° C. or more. Suitable solvents include the aromatic hydrocarbon solvents, such as cumene, p-cymene, xylene, toluene, etc. Other suitable solvents are the ketones, such as methylethylketone. The preferred manner of carrying out the polymerization is by what is known as incremental feed addition. By this method the monomers and catalyst are first dissolved in a portion of the solvent in which the polymerization is to be conducted and the resulting solution fed in increments into a reactor con-